

HABITAT SELECTION AND SPATIAL DISTRIBUTION OF SPIDERS IN COASTAL SAND DUNES

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av

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The thesis is based on the following papers:

- I Seasonal growth of some dune-living spiders. - Oikos 20:392-408 (1969).
- II Thermal tolerances and preferences of some dune-living spiders. - Oikos 21:230-236 (1970).
- III Resistance to desiccation in some dune-living spiders. - Oikos 22:225-229 (1971).
- IV Spider associations in coastal sand dunes. - Oikos 24: (1973). In press.
- V Habitat selection by spiders on coastal sand dunes in Scania, Sweden. - Ent. scand. 4 (1973). In press.

In the following these papers are referred to by the Roman numerals given above.

INTRODUCTION

The coastal sand dunes at Sandhammaren in South Sweden constitute an ecosystem characterized by unstable foreshore and dunes that become gradually more stable inland. The relief pattern of the topography results in widely varying environmental conditions. The patchy growth of plants, the habitats of the spiders, contributes to the structural di-

versity. The present thesis analyses the matrix of the distribution and the habitat selection of the spiders inhabiting the ecosystem.

MATERIAL AND METHODS

The field investigation is based on quantitative sampling. 821 samples of 1 m² each were chosen at twelve periods in the course of 17 months. In the foreshore area the spiders were collected by hand from enclosed quadrates, while further inland the sample material was sieved before sorting (I, IV). The specimens obtained were recorded as far as possible with regard to sex and to stages or size-groups (I). Thermal tolerance of the species studied was determined by freezing to various temperatures and exposure to a constant frost for 72 hr. The thermopreferendum was examined by means of a circular copper arena with temperature, humidity and evaporation gradients. By keeping spiders in vials that were gradually warmed in water bath, the mean escape reaction temperature and the upper lethal temperature were determined (II). The resistance to desiccation was studied by keeping the spiders in closed tubes with various salt solutions in the lower parts. For studying wind behaviour a closed tunnel with a fan was used (III). The bioclimate was measured by thermistors, Assmann-psychrometer, hair hygrometer and hot wire anemometer (V).

THE ABIOTIC ENVIRONMENT

The sand of the dunes consists to ca 90 % of grain sizes between 0.2 and 0.6 mm. *Ammophila arenaria* (L.) Link. dominates the vegetation; the highest coverage is on the seaward side of the large dune ridge. On the dune heath with a discontinuous cover of lichens, *Calluna vulgaris* (L.) Hull, *Salix repens* L. coll. and *Empetrum nigrum* L. formed a scattered mosaic; moss

areas were small and rare (I, IV, V). The *Ammophila* stands both on the heath and on the foreshore constituted a warmer environment than the other plant communities on sunny summer days, while on rainy, windy, and winter days no differences in the various vegetation types occurred. The humidity was often high near to sea but decreased inland. The aspects of the dunes affected the microclimate considerably. Temperature and humidity gradients within the plant stands also varied according to structure and density of the stands (V).

TOLERANCE AND PREFERENCES OF THE SPIDERS

In summer the lower lethal temperature ranged between -6.8° and -11.1°C of the species studied, while in winter most species were adapted to cold and the range was between -6.7° and -20.9° . The upper lethal temperature was studied in the summer, when LT_{50} was between 37.4° and 46.4° of the species investigated (II). All species studied except one had a pronounced escape reaction temperature with values between 30° and 42.9° (V). The thermal preference was always coupled with the humidity range and was species-specific. The lowest thermal preference of the 16 species studied was assessed at 14° and the highest at 27.5° . The dune-living spiders had a high resistance to desiccation, the nymphs showed a lower resistance than the adults and among the nymphs resistance increased with age. Ground-dwelling species had a very low tolerance to wind, which was not the case with species living in the upper parts of the vegetation (III).

THE MATRIX OF THE SPECIES

The association between the species was investigated by a method based on presence and absence in the 821 samples, when the species were compared in pairs. Seven separate groups were distinguished. By a grouping method using distance functions with an adjustable index, the relations between species, topo-

graphy, and plants were investigated. Seven taxicoenoses were connected to specific habitats. By adjusting the distance function index the homogeneity of the taxicoenoses and their habitats can be tested at different profiles. The large dune ridge was the main habitat of the area. Data on seasonal migrations was also obtained (IV).

THE HABITAT SELECTION

Occurrence was correlated to thermal tolerance, preferences, escape reaction and resistance to desiccation of the species examined and to the pattern of the environment, including the vegetation. The interaction between these factors affected the distribution of species and their abundance. Temperature in particular proved to be a critical factor at the habitat selection (V).

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